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ABSTRACT

This report addresses the relationship between tuition, financial aid, and access to public higher education through an economic analysis of data from individual states from 1976 to 1993. The analysis focuses on states, rather than the individual, as the unit of observation and how state policies regarding the setting of tuition rates and financial aid budgets affect access to public higher education. The first part of this study provides an analysis of public higher education enrollment rates in the United States during this period; the second part offers a fixed-effects model utilizing cross-sectional and time-series data. The model takes advantage of the natural variations in the outcome and predictor measures both across states and over the time period involved. Findings are consistent with many previous student demand studies; first-time enrollees should be more price sensitive as they have not yet made an investment in a postsecondary education. Already enrolled students, especially those in upper division levels, should be more willing to pay higher tuition levels to complete a degree program and gain the benefits in the labor market of having a college diploma. This study also confirms that at least among some groups, higher levels of grant spending are associated with higher enrollment rates. The positive relationship between unemployment and enrollment is confirmed. The model allows each state to predict its enrollment rate for each racial group; it also allows identification of the states and years when enrollment rates for specific groups were high or low. (Contains 22 references.) (NAV)

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Tuition Prices, Financial Aid, and Access To Public Higher Education: A State-level Analysis

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Contents

1. Introduction 1

2. Findings From Previous Research 3

3. Methodology and Data Sources 7

4. Trends in Public Higher Education Enrollment Rates, 1976 to 1993 8

5. Findings From Estimating the Fixed-Effects Models 11

6. Conclusions and Plans for Further Research 18

Appendix A: Tuition and Fees at Public Colleges and Universities, 1989-1990 and 1993-1994 21

References 22

List of Tables and Figures

Table 1: Descriptive Statistics of State-Level Data, 1978 to 1993 12

Table 2: Coefficients (Standard Errors) of Fixed-Effects Models 15

Table 3: Changes in Enrollment Rates Associated With Changes in Predictors 17

Figure 1: Total Public Undergraduate Enrollments by Race, 1976 to 1993 8

Figure 2: Public Undergraduate Enrollment Rates, 1976 to 1993 9

Figure 3: Public Undergraduate Enrollment Rates Indexed to 1976 10

Figure 4: Public Undergraduate Enrollment Rates by Region, 1976 to 1993 11

Figure 5: Comprehensive University Resident Tuition by Region (in 1993 Dollars), 1976 to 1993 13

Figure 6: State Need-Based Grant Spending per 18 to 24 Year-Old (in 1993 Dollars), 1976 to 1993 14

Figure 7: Predicted Enrollment Rates by Race 17

Figure 8: Comparison of Residuals From Black and White Models 19

1. Introduction

Policy makers have long been concerned with the cost of higher education, and whether that cost provides an obstacle for entry by certain students. As far back as 50 years ago, President Truman's Commission on Higher Education sounded an alarm concerning equality of access to the nation's colleges and universities:

> By allowing the opportunity for higher education to depend so largely on the individual's economic status, we are not only denying to millions of young people the chance in life to which they are entitled; we are also depriving the nation of a vast amount of potential leadership and potential social competence which it sorely needs. (quoted in Mumper, 1996, p. xv)

The 1980s and 1990s have seen unprecedented increases in tuition rates at public and private universities. While the early to mid-1980s saw large increases primarily at private universities, fiscal pressures on states during the late 1980s and into the 1990s forced tuition increases at public institutions that far exceeded inflation. Examples of increases in public college tuition are shown in Appendix A. In every category of institution, real tuition rates *after* inflation increased at least 5% per year from 1989 to 1993. These increases occurred at a time when family incomes decreased in real terms.

A major concern with these recent tuition increases is whether access to public higher education has been affected, especially for students who historically have relied on public colleges for postsecondary education. While microeconomic theory demonstrates a downward-sloping demand curve for higher education (as tuition increases, enrollments would decrease, *ceteris paribus*), the impact of tuition changes may vary depending upon changes in other factors. These other factors may include the size of the college-high school earnings gap (also known as the college wage premium), students' ability to pay for college, and the availability and desirability of alternatives to college, such as entering the workforce or the military.[1] The demand for higher education may also be affected by differences in students' "tastes," or preferences, which may include their willingness to pay for college.

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[1] To understand the importance of these other factors, one need only examine the history of higher education enrollments in the 1980s. Tuition levels during the decade were increasing at the fastest rate in history at the same time that the number of high school graduates was shrinking by 17% as the last of the baby boomers graduated from high school. Yet college enrollments continued to grow due primarily to an increase in participation rates, especially among women and older students. This result was the opposite of that predicted by many researchers and policy makers. See for example McPherson (1978), and many of the other essays in that volume.

In this paper, I address the relationship between tuition, financial aid, and access to public higher education in the U.S. through an analysis of data from individual states from 1976 to 1993. This subject is important for a number of reasons. If higher tuition does restrict access to public institutions by those most dependent upon them, minority and lower-income students may have no other options for obtaining a college degree. As over 80% of undergraduates today attend public institutions, maintaining access to these schools is critical. Decreasing enrollment rates of minority students (relative to whites) may be one indicator that these students are having trouble affording college.

In addition, a baccalaureate education is critical to earning a livable wage today. A recent Census Bureau publication (Kominski and Sutterlin, 1992) shows that the average earnings of workers over 18 with a bachelor's degree are almost twice those possessing only a high school diploma. The difference is even greater for blacks. Restricting access to higher education may serve to exacerbate the earnings gap between blacks and whites.

Financial aid programs administered by federal and state governments were created originally to equalize educational opportunity for underrepresented groups.[2] Financial aid acts as a price discount, lowering the net cost paid by recipients. When addressing the relationship between tuition and access to higher education, then, it is critical also to examine the impact of financial aid on that relationship.

The specific research questions I address in this paper are:

1. How have the public higher education enrollment rates of white and minority students changed during the period from 1976 to 1993?
2. As states increase public college and university tuitions, is there a disproportionate impact on the enrollment rates of minority students versus white students?
3. Do changes in state need-based grant budgets affect the enrollment rates of white and minority youth differently?

Most other studies that have examined the relationship between price and access have focused on the individual as the unit of observation. Those studies are usually conducted using cross-sectional databases such as the National Longitudinal Survey of Youth or the High School and Beyond Survey. This analysis focuses on states as the unit of observation, and how state

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2 While the majority of aid awarded by the federal government and state grant programs is need-based, institutional aid is awarded based on both need and merit. The percentage of merit aid awarded by institutions has been on the rise in recent years, with the greatest increases at public institutions (McPherson and Schapiro, 1994). While total institutional aid is still less than 20% of all aid awarded, its share has been growing in recent years (The College Board, 1993).

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policies regarding the setting of tuition rates and financial aid budgets affect access to public higher education.

2. Findings From Previous Research

Researchers have long studied the effect of tuition on enrollment in higher education. These studies have sought not just to confirm the existence of a downward-sloping demand curve for higher education, but to provide more information regarding the nature of that curve. Is the relationship between tuition and enrollment linear or curvilinear? How sensitive is enrollment to tuition at different price levels? Do students with different characteristics have different demand curves?

When examining the relationship between tuition and enrollment in higher education, it is problematic to exclude the existence of financial aid in the equation. As described earlier, financial aid acts as a price discount, serving to lower the net cost paid by the student. Nevertheless, there is some evidence to indicate that students react differently to the posted tuition level, often referred to as the "sticker price," than they do to the actual price they pay after taking financial aid into account.[3]

Most multivariate analyses that examine the relationship between tuition and enrollment, generally referred to as student demand studies, fall into two categories: 1) cross-sectional studies, or 2) time-series studies. Cross-sectional studies examine how individual students behave in the face of various postsecondary options. Researchers use multivariate analysis on datasets such as the High School and Beyond survey to measure the impact of tuition and aid on individual students' decisions to attend college or not. These analyses measure how much of the college-going decision is based on price, as compared to other factors.

An alternate methodology is time-series analysis. Time-series studies examine changes over time in aggregate enrollments of students (e.g., in the entire U.S. or in individual states or institutions). These studies relate changes in aggregate enrollments to tuition changes during the given period.

Each approach has advantages and limitations. While cross-sectional studies often have large sample sizes, and therefore much statistical power to examine subsets of data (e.g., racial or income categories), they commonly measure tuition sensitivity at only a single point.

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[3] Most researchers exclude the cost of room and board in the calculation of the sticker price, as they assume that these subsistence costs would be borne by the student even if he chose options other than attending college.

They thus do not provide a measure of how tuition sensitivity changes over time. In addition, they generally only measure the tuition sensitivity of first-time enrollees, not total undergraduate enrollments. Time series analyses examine behavior over multiple periods and thus have the ability of measuring how enrollments change in response to tuition changes in multiple years, but often are unable to track changes in the choices of individual students or groups of students.

A 1988 book by Larry Leslie and Paul Brinkman often is referred to as the classic analysis of student demand studies. They reviewed 25 studies published between 1967 and 1982, including both cross-sectional (five) and time-series (20) analyses. The studies examined different types of institutions, public and private, 2-year and 4-year. The authors calculated an overall student price response coefficient (SPRC), a measure of students' sensitivity to tuition increases. They found that

> The results of all studies were in the expected direction; that is, enrollments declined when prices increased...The average SPRC for the 25 studies was about -0.7; that is, for every $100 increase in tuition price, one would expect...a drop of 0.7 percentage points in the first-time enrollment rate.[4] (p. 125)

The SPRCs the authors calculated from the 25 studies ranged from -0.2 to -2.4.[5] It is important to note that this SPRC range applies to first-time enrollees only.

Leslie and Brinkman's meta-analysis was an important contribution to the literature. It confirmed the findings of earlier meta-analyses performed by Jackson and Weathersby (1975) and McPherson (1978). Jackson and Weathersby examined seven studies and found SPRCs from -0.05 to -1.46. McPherson examined ten studies and found SPRCs from -0.05 to -1.53. Both of these ranges are similar to that of Leslie and Brinkman when one takes into account that the SPRCs in the two earlier studies were normalized to 1974 dollars.[6]

Many studies have been published since these three meta-analyses were conducted. Some help fill the methodological gaps left by the earlier studies; many address later cohorts of students. Almost all of these studies are consistent in one respect: each found an inverse relationship between tuition and the probability of enrollment in higher education. The exact size of the effect may differ depending upon the methodology used, the dataset analyzed, and the type of students or institutions examined. But the magnitude of the effect is remarkably

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4 In this and other studies, measures of tuition sensitivity are represented for the "mean" student, i.e., all other characteristics are held to their means.

5 Two studies had positive SPRCs. One of these utilized only descriptive statistics, and the other examined only applicants to community colleges in New York in a single year.

6 See Leslie and Brinkman (pp. 129-131) for a discussion of some of the problems with the Jackson and Weathersby analysis, and its applicability to their own work.

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consistent across most of these studies. The evidence indicates that a tuition increase of $100 is consistent with a drop in enrollment of somewhere in the range of 0.50 to 1.00 percentage points. It is important to note that these changes assume all other variables that affect enrollment demand are held constant.

Another consistent finding among many of these studies is that there is a relationship between race, income, and sensitivity to tuition and financial aid. While the magnitude of the effect differs across studies, most researchers find that poorer students are more sensitive to increases in net cost, whether those increases take the effect of tuition increases or financial aid decreases. Tuition increases that are not offset by concomitant increases in financial aid appear to have the effect of reducing access to higher education for our country's poorest students. In addition, there is a good deal of evidence that black students are more sensitive to college costs than white students, even controlling for income, socioeconomic status, and ability. For Hispanic students, the evidence is more mixed. While some authors found that Hispanic students tended to react to tuition and aid changes in a fashion similar to that of black students, others found a different response. Very few quantitative analyses have examined demand for higher education by other racial groups.

One serious obstacle to using the findings of these earlier studies to inform current policy is that the studies were conducted when tuition levels were significantly lower than today.[7] Thus, if the tuition demand for higher education is curvilinear, SPRCs today may be larger than what the authors found, indicating that students are more sensitive to tuition increases given tuition levels in more recent years. In addition, many of the studies examined enrollments in only one or two states, or even a single institution, thus limiting the ability to compare policies across states and their effect on access to public higher education.

Even given this caveat, however, it is clear there is an inverse relationship between tuition and enrollment. Both the cross-sectional and time-series evidence is consistent on this issue.

Many of these same studies examined the relationship between student financial aid and enrollment in colleges and universities. One issue that complicates the analysis of this relationship is that "financial aid" is not a singular entity, but is a term that incorporates many different forms of student financial assistance. This includes grants, subsidized loans, unsubsidized (market rate) loans, tuition remission, and work study wages. The net cost paid by the recipient of a $1,000 grant is different than that of a student receiving a $1,000 subsidized

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7 1976 was the latest year for which data were analyzed in the studies reviewed by Leslie and Brinkman. Most of the later studies used data from the mid-1980s or earlier.

loan. Economists would argue that these two could be compared simply by calculating the subsidy value of the loan, and comparing this to the grant. Yet in practice, it appears that students are not always rational economic actors, and they react differently to various forms of financial aid and tuition changes, even if the economic value of each is the same.

There is also evidence that students react to the "sticker price" of the college, either because they are not aware of the existence of financial aid or do not believe they would qualify for it.[8] In a recently issued book, Mumper (1996) summarizes the dilemma facing policy makers who seek to use financial aid to lower the cost of higher education for needy students:

> A plan which may look good in an economics class may prove counterproductive in the real world of college finance. In this view, lower-income students are likely to become discouraged by rapid increases in the "sticker price" of higher education. This occurs because information about tuition levels is much more widely known and available than is information about financial aid programs. (p. 45)

The evidence for this view can be seen in many of the studies described in Heller (1996). Those studies that analyze the relationship between enrollment and tuition changes compared to financial aid awards generally find different-sized effects for each. Similarly, those studies that include different types of aid as explanatory variables (i.e., grants versus loans) find different effects for each type.

The evidence regarding the relationship between financial aid and access to higher education is more complex than the findings on tuition. While difficult to generalize, those researchers who conducted cross-sectional analyses of the major longitudinal datasets (NLS72, NLSY, and HSB) found that students were sensitive to aid awards when they made the decision to enroll in college. The level of that sensitivity varied from study to study, depending upon the type of aid (grants, loans, or work study) and dollar value of the aid. The effect that aid has on enrollments is difficult to compare with that of tuition; while some of these studies found similar effects between the two (i.e., a $100 increase in aid would have roughly the same effect on enrollments as a $100 decrease in tuition), others found students to be less sensitive to aid than tuition.

The evidence from time-series studies is more mixed, however. Some researchers concluded that grants had no significant effect on access. Others came to different conclusions, based on different interpretations of the data.

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8 For an excellent review of the literature on this topic, see O'Brien (1992).

3. Methodology and Data Sources

The first part of this study provides an analysis of public higher education enrollment rates in the United States during the period from 1976 to 1993. Since the 1960s, the National Center for Education Statistics (NCES) of the Department of Education has collected enrollment data from all colleges and universities in the U.S., and since 1976, has collected data on enrollments by race.[9] These data provide an annual census of enrollments in this country's non-profit postsecondary institutions. The analysis here is limited only to accredited, degree-granting public institutions under the control of one of the fifty states.

The enrollment data were collected by NCES on the HEGIS and IPEDS survey forms. The IPEDS and HEGIS data used in this analysis are from the CASPAR database, from Quantum Research Corporation (1995).

In calculating enrollment rates, one must make an assumption regarding the population group on which to base the rate. Traditionally, researchers have used the 18-24 age group as the denominator of the ratio between enrollments and population. While some recent studies have documented the aging of the college-going population, in this study I have chosen to restrict the analysis to the 18-24 age group in each state as the base, while acknowledging that the enrollments include students from all age groups.[10] These numbers should more accurately be called "enrollment ratios," rather than "enrollment rates," but for simplicity of language I will retain the traditional wording of "enrollment rates." The population data used in calculating the enrollment rates comes from Census Bureau data from the 1980 and 1990 Censuses, as well as inter-censile estimates for the non-census years.

The second half of this study estimates a fixed-effects model utilizing cross-sectional and time-series data. The general form of the model is:

$$r_{ijt} = \beta_0 + \beta_1 p_{jt} + \beta_2 a_{jt} + \beta_3 c_{jt} + \delta_j + \phi_{it} + \varepsilon_{ijt}$$

where

r_{ijt} = Enrollment rate of race *i* in state *j* in year *t* (total enrolled divided by 18-24 population)

p_{jt} = Vector of tuition prices in state *j* in year *t*

a_{jt} = Vector of financial aid budgets in state *j* in year *t*

c_{jt} = Vector of economic controls in state *j* in year *t*

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9 Racial data were collected in even years beginning in 1976 and every year since 1990.

10 See Koretz (1990) for an analysis of the different methodologies for calculating enrollment rates.

δ_j = State fixed effects

ϕ_{dt} = Year effects, which are allowed to vary by Census division *d*

This model, combining cross-sectional and time-series analysis, takes advantage of the natural variations in the outcome and predictor measures both across states and over the time period involved. The data in the model are weighted by the square root of the 18-24 population in the 1990 Census for each state.

Data on tuition prices is from the Washington Higher Education Coordinating Board (1994), who conducts an annual survey of public college and university tuition rates in each state. Data on state need-based financial aid budgets comes from the National Association of State Scholarship and Grant Programs (1994), which similarly conducts an annual survey. Data on unemployment rates is from the Bureau of Labor Statistics (1996).

4. Trends in Public Higher Education Enrollment Rates, 1976 to 1993

Figure 1 shows the total headcount enrollments for the four largest racial groups in public colleges and universities from 1976 to 1993. Enrollments peaked at almost 10 million in the early 1990s, with the largest gains occurring in the 1980s and early 1990s.

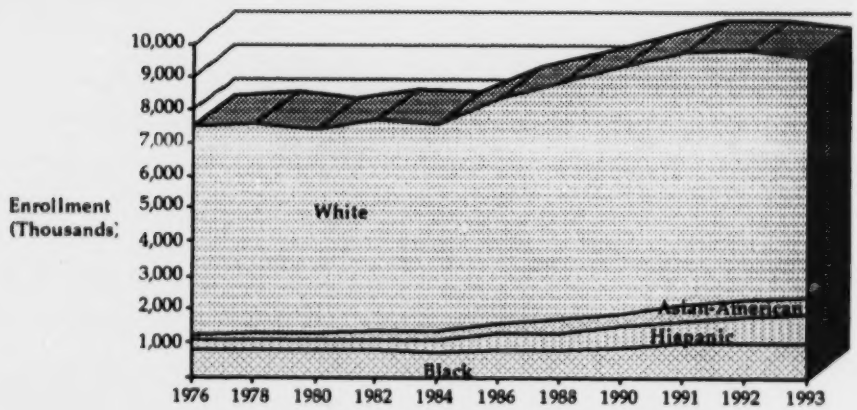

Figure 1: Total Public Undergraduate Enrollments by Race, 1976 to 1993

More illustrative of gains in college enrollment is an examination of enrollment rates. As described in the previous section, "enrollment rate" in this study refers to the number of students enrolled divided by the 18 to 24 year-old age group. Figure 2 shows the national public undergraduate enrollment rates for these same racial groups. As can be seen in the figure, Asian-American students consistently enrolled in public institutions at rates higher than those of the other races, followed by whites, blacks, and Hispanics. In addition, all groups had higher enrollment rates in 1993 than they did in 1976, with the largest gains coming in the mid-1980s to the early 1990s. This followed a dip in enrollment rates for all four racial groups in the late 1970s.

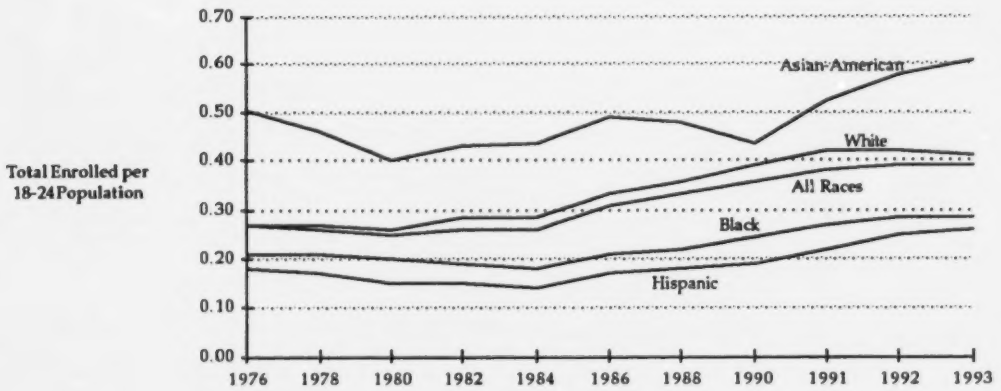

Figure 2: Public Undergraduate Enrollment Rates, 1976 to 1993

In order to gain a better perspective on how the enrollment rate of each group changed relative to the others, the rates can be indexed to a common base in 1976. Figure 3 shows each group indexed to a base of 100 in 1976, with the subsequent changes representing percentage increases or decreases from the base. For example, in 1993 white students enrolled in public institutions at a rate approximately 50% greater than in 1976. This represented the largest gain of any of the four major racial groups. Hispanic students made the next largest gain, enrolling at a rate 45% greater than their 1976 rate. Asian-American students, who started with a larger enrollment rate than the other groups (see Figure 2), made the smallest gain of 20%.

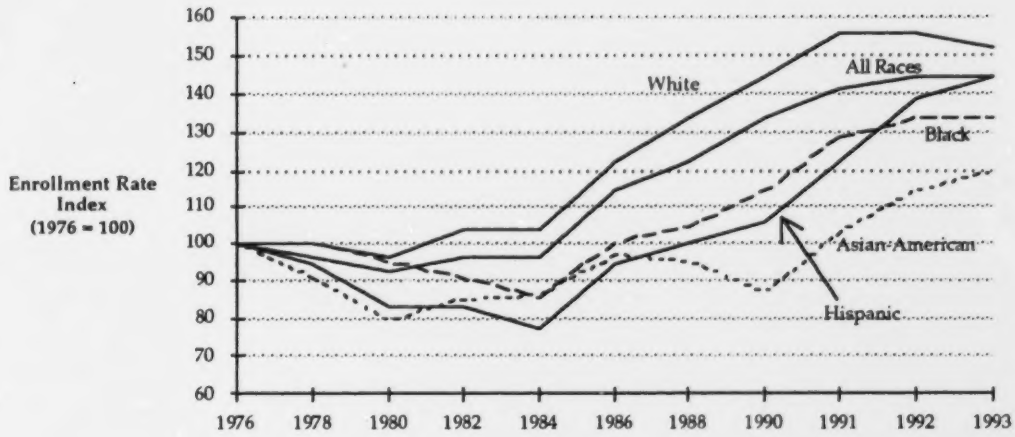

Figure 3: Public Undergraduate Enrollment Rates Indexed to 1976

Enrollment rates differ across the country due to a variety of factors. Perhaps the most critical differentiating factor is the regional influence. States in the northeast, for example, have a long history of private higher education. These states tend to have a high proportion of students enrolled in private postsecondary institutions. In the west, in contrast, higher education is dominated by the public institutions, who enroll the vast majority of undergraduates. This regional effect can be seen in Figure 4. It shows that while enrollment rates generally rose during this period, there are large differences across regions. In addition, enrollment rates in some regions grew at a faster rate than in others.

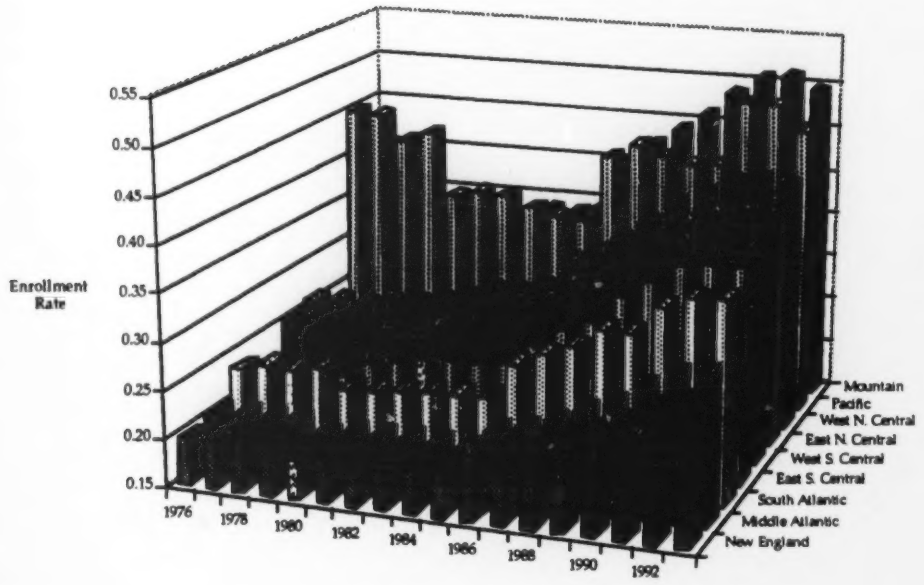

Figure 4: Public Undergraduate Enrollment Rates by Region, 1976 to 1993

5. Findings From Estimating the Fixed-Effects Models

The analysis on this section was conducted on a subset of the data. State need-based grant data were available beginning in 1978, so the period of analysis is 1976 to 1993. Enrollments from the District of Columbia are not included, because the District does not have a public postsecondary system controlled by the "state" as the 50 states do. The Washington Higher Education Coordinating Board did not provide the community college tuition for New Hampshire and South Dakota. Similarly, the comprehensive tuition rate was not available for the following states: Alaska, Delaware, Hawaii, and Wyoming. These six states are not included in the analysis. However, because each is relatively small in population, leaving them out of the analysis does not greatly affect the results.

The biggest issue to address in an analysis of this type is the influence of California over the results. California is an outlier of sorts for a number of reasons. It historically has had

very low public tuition rates (until 1983, for example, the California Community Colleges were free for resident students). It also has had unusually high public enrollment rates, at least partially because of the dominance of the public system over private institutions. For every racial group with the exception of Hispanics, the public enrollment rate in California was at least 50% higher than the average of the other 49 states. The last critical factor is California's sheer size. In 1993, California represented over 12% of the 18 to 24 population of the country, and 15% of the public college undergraduates. In a weighted least squares analysis, California overly dominates the national results because of these issues. Thus, the analysis that follows does *not* include California, the District of Columbia, or the six states listed above.

Summary statistics on the data included in this study are presented in Table 1. Means and standard deviations are provided both unweighted, and weighted by the square root of the 18 to 24 population in the state in the 1990 Census.

Table 1: Descriptive Statistics of State-Level Data, 1978 to 1993

Variable	Unweighted Mean (SD)	Weighted Mean (SD)	Minimum	Maximum
Resident Community College Tuition (hundreds of 1993 dollars)	9.61 (3.70)	9.94 (3.90)	1.34	20.93
Resident Comprehensive University Tuition (hundreds of 1993 dollars)	16.85 (5.84)	17.19 (6.00)	5.91	37.41
State Need-Based Grants per 18-24 year old (1993 dollars)	52.17 (63.80)	64.75 (76.13)	2.04	548.34
Annual Unemployment Rate	.069 (.021)	.068 (.021)	.022	.180
Enrollment Rate - All Races	.29 (.08)	.30 (.09)	.15	.65
Enrollment Rate - Blacks	.23 (.07)	.23 (.08)	.05	.71
Enrollment Rate - Hispanics	.18 (.11)	.17 (.12)	.03	.82
Enrollment Rate - Asian-Americans	.40 (.15)	.39 (.15)	.07	.85
Enrollment Rate - Whites	.33 (.10)	.34 (.11)	.14	.74

It is the variation in these measures that creates the natural experiment that allows us to test the relationship between tuition, financial aid, and enrollment in public higher education. The variation in the outcome variable, enrollment rates, was shown in Figure 4. Figures 5 and 6 provide examples of the regional variations in comprehensive university tuition rates and need-based grant spending per 18 to 24 year-old. Figure 5 shows that tuition rates fell in real terms in every region in the mid- to late-1970s. The 1980s saw real increases in tuition, with a large escalation of those increases in the north and eastern part of the country in the late-1980s and 1990s. Tuitions in that part of the country were approximately double those in the west by 1993.

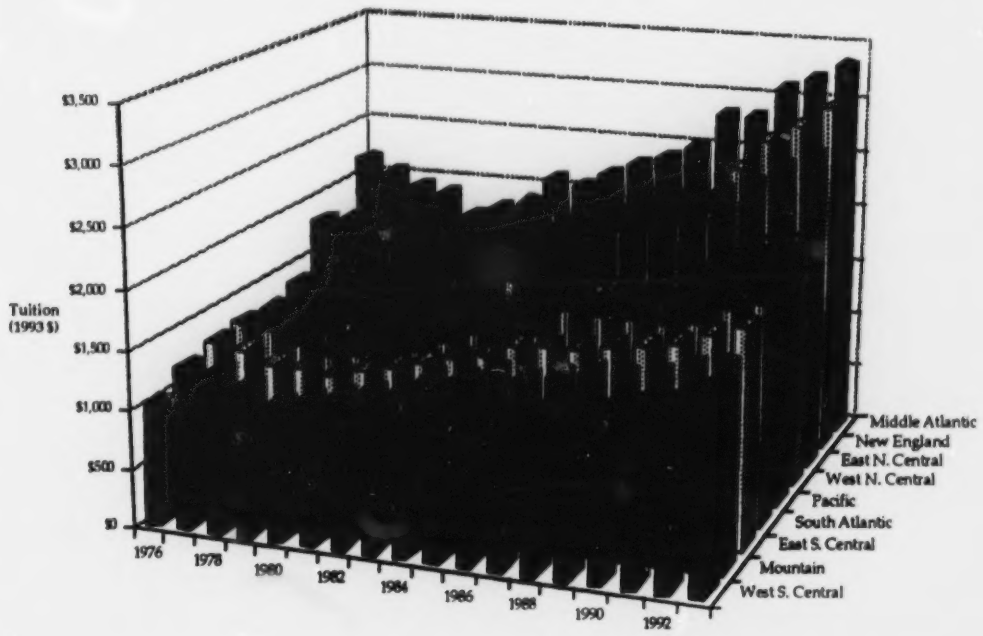

Figure 5: Comprehensive University Resident Tuition by Region (in 1993 Dollars), 1976 to 1993

Figure 6 shows that state spending on need-based grants also varies by region. In general, those regions with higher tuition levels — such as the eastern part of the country — generally have higher levels of aid spending. These states, whether through explicit policy

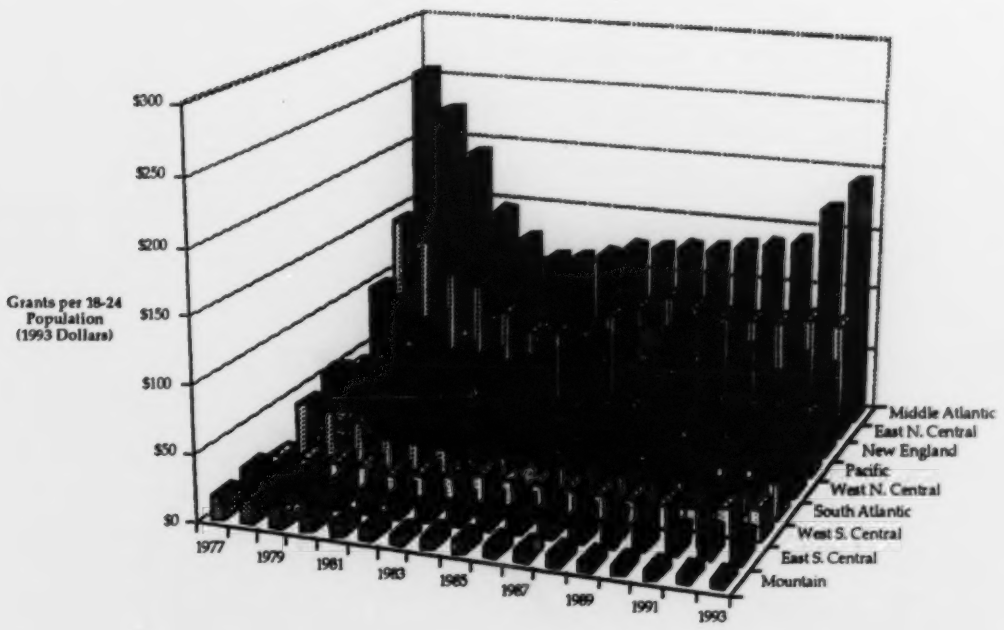

Figure 6: State Need-Based Grant Spending per 18 to 24 Year-Old (in 1993 Dollars), 1976 to 1993

prescription or by chance, practice the high tuition/high aid strategy of funding public higher education.[11] With the exception of the West South Central (Oklahoma, Texas, Arkansas, and Louisiana) and Pacific regions however, grant spending was lower in 1993 in real terms than in 1976. Thus, when real tuition levels are at an all-time high, state spending on need-based grants has fallen in real terms.

The trends outlined in the last two sections lead to the primary focus of this study: do increases in public college tuition (and/or cuts in state grant spending) affect access to public higher education, and if so, to what extent? To answer this question, the fixed-effects model described in section 3 was fit for each of the four largest racial groups and for all races combined. The results of those models are shown in Table 2.

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11 See Hauptman (1992) and Wallace (1992) for analyses of this strategy.

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Table 2: Coefficients (Standard Errors) of Fixed-Effects Models

Undergraduate Enrollment Rate of:	Community College Tuition (1993 $00s)	Comprehensive University Tuition (1993 $00s)	Unemployment Rate	State Grants per 18-24 Population (1993 $)	N
All Races Combined	-.0036*** (.0009)	-.0003 (.0005)	.4482*** (.1004)	.00012** (.00004)	682
Black	-.0044** (.0015)	.0009 (.0009)	.6461*** (.1743)	.00014* (.00006)	426
Hispanic	.0015 (.0029)	-.0002 (.0016)	.7243* (.3260)	-.00005 (.00012)	426
Asian-American	-.0125*** (.0036)	.0055** (.0020)	1.7881*** (.4108)	.00021 (.00015)	426
White	-.0034** (.0013)	-.0007 (.0007)	.5478*** (.1472)	.00009~ (.00005)	426

~p≤.10 *p≤.05 **p≤.01 ***p≤.001

Note: All models include state fixed effects and division by year interactions.

Table 2 shows that with the exception of Hispanics, all groups tend to enroll in college at lower rates as tuition increases. For example, for all students, a $100 increase in real community college tuition is associated with a drop of .36 percentage points in the enrollment rate, all other things being equal.[12] The enrollment rate of Asian-American students showed the largest tuition sensitivity, with an estimated drop of 1.25 percentage points for every $100 increase in real tuition prices. This relatively large effect needs to be considered carefully, however, as Asian-Americans of college-going age tend to be clustered in a small handful of states, even when California is excluded from the analysis.

When taken together, the community college tuition dominates that of the comprehensive universities.[13] With the exception of the model of Asian-American enrollment

[12] If California were included in the analysis, the all-race coefficient increases to -.0027. No other single state, when dropped from the analysis, was found to have an effect on the results of the magnitude that California had.

[13] The coefficient of the flagship university tuition price was not found to be statistically different from zero in any of the models. In addition, the models were also estimated with lagged community college tuition values to see if enrollments were sensitive to the previous year's tuition level, rather than just the current year. For each model, the sensitivity to the previous year's community college tuition price was roughly the same as the current year's price, a finding that would be expected given the high correlation of tuition prices on a year-to-year basis.

rates, none of the comprehensive university tuition effects were significantly different from zero.

Since attending college can be a substitute for entering the workforce, many researchers have hypothesized that unemployment may be positively associated with college enrollment, i.e., as employment possibilities lessen, individuals may be more likely to enter college.[14] Thus, college enrollments may be affected by the economic condition of the state. The results of these models confirm that finding. For every group, higher unemployment rates are associated with higher enrollment rates. For all students, a one point increase in the unemployment rate is associated with an enrollment increase of .45 points, *ceteris paribus*. Black and Hispanic students are more sensitive to changes in employment levels than are other students, with the exception of Asian-Americans. As noted earlier, the results with respect to Asian-American should be taken with the knowledge that they tend to be clustered in a few states.

For all students together, and for black students, higher levels of need-based grant spending are associated with higher enrollment rates. This finding is also consistent with the literature on financial aid. If aid serves to reduce the net price paid by the students, then one would expect increases in grant spending to be related to higher enrollment rates, *ceteris paribus*. From these models, however, it appears that blacks are the only single group for whom enrollments are sensitive to grant spending levels, though overall enrollment rates are sensitive to grant budgets.

Figure 7 plots the predicted enrollment rates of each of the racial groups against community college tuition, with all other predictors held constant at their means. As can be seen, Asian-American enrollments are most sensitive to tuition increases. At high real tuition levels, their enrollment rates would be predicted to decrease to a level less than all other groups with the exception of Hispanics. As noted above, however, this large coefficient is likely the result of the clustering of Asian-Americans in a small number of states. The upward-sloping line for Hispanics is the result of a coefficient that is not statistically different from zero.

The practical implications of these findings are summarized in Table 3. Each of the predictors that are statistically significant at a level of $\leq .05$ are allowed to vary by one standard deviation. The associated change in enrollment rates for each group is shown.

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[14] See for example Ahlburg, McPherson, and Schparo (1994) , Blakemore and Low (1983), Corazzini, Dugan, and Grabowski (1972) and Jackson (1988).

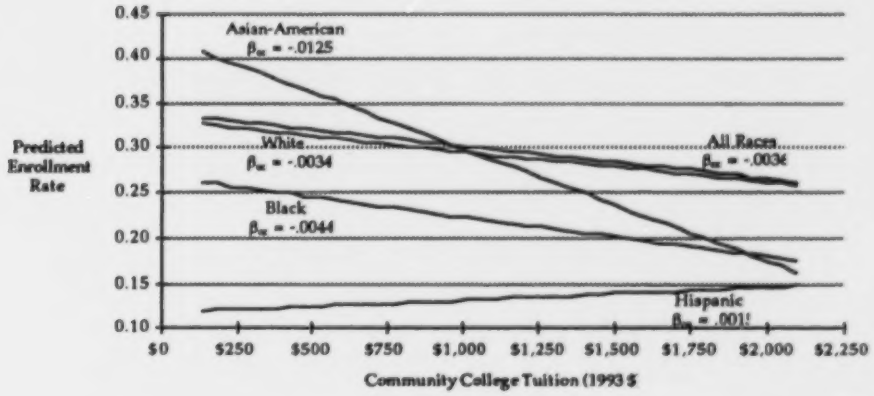

Figure 7: Predicted Enrollment Rates by Race

To understand the policy implications of these findings, you can examine how much states would have to increase their need-based grant spending in order to offset tuition increases. For a community college tuition increase of $195 in real terms (one-half standard deviation), need-based grant spending would have to be increased by $58.34 for every 18 to 24 year-old in a state to offset the tuition increase. In 1993, this was well over the median state's grant budget of $34.24. Thus, states would have to greatly increase their grant budgets in order to offset the impact of tuition increases.

Table 3: Changes in Enrollment Rates Associated With Changes in Predictors

	Predictor and Standard Deviation		
	Community College Tuition ($390)	Unemployment Rate (2.1 points)	State Grants per 18-24 Population ($76.13)
All Races Combined	1.40 points	0.94 points	0.91 points
Black	1.72 points	1.36 points	1.07 points
Hispanic	—	1.52 points	—
Asian-American	4.88 points	3.76 points	—
White	1.33 points	1.15 points	—

Another way of analyzing this relationship is by looking at the actual increases in tuition and grant-spending in one year. In 1993, the median community college tuition increase was $51. Given the results of the models fitted here, one would expect a resultant drop in enrollment of all students of .184 points. The median increase in grant spending per 18 to 24 year-old in the same year was $3, or enough to help increase enrollments by only .036 points. Thus, the median grant budget increase offset only about 20% of the enrollment drop due to increased tuition prices.

6. Conclusions and Opportunities for Further Research

The findings of this study are consistent with those of many previous student demand studies. While Leslie and Brinkman (1988) estimated a student price response coefficient (SPRC) of approximately -0.70 for a $100 tuition increase, the equivalent SPRC here is -0.36. One would expect a lower measure here, however, as this study analyzed the enrollment response of *all* students, not just first-time enrollees. All other things being equal, first-time enrollees should be more price sensitive, as they have not yet made an investment in a postsecondary education. Already-enrolled students, especially those in upper division levels, should be more willing to pay higher tuition levels in order to complete a degree program and gain the benefits in the labor markets (and elsewhere) of obtaining a college diploma.

These findings are also consistent with differences in tuition sensitivity among the races. As Heller (1996) concluded in his review of the literature on student demand, black students generally are found to have higher price sensitivities than white students. He also found that the results of other studies with respect to Hispanic students were mixed, with some finding their response to be more like white students, and others finding it to be more like that of blacks. Few of those studies analyzed Asian-Americans as a separate group. This study also confirms the findings with respect to grants, that at least among some groups, higher levels of grant spending are associated with higher enrollment rates. In addition, the positive relationship between unemployment and enrollment is confirmed here.

This study has helped to expand the literature on student demand studies by examining the potential impact of state policies regarding tuition prices and need-based grant spending. It is clear, however, that price alone does not determine whether or not students go to college. If this were the case, enrollments should have dropped in the last decade as real public tuition levels rose at rates that far exceeded the ability of students and families to pay for college.

One benefit of the methodology used in this study is that it provides a benchmark "performance level" for states, given a number of characteristics: specific state attributes, such as the history of private higher education and region of the country (the so-called "state effects"); tuition levels; grant spending; and economic conditions. The models allow you to estimate for each state what its predicted enrollment rate should be for each racial group, given these characteristics.

Figure 8 shows a plot of the residuals from the black model against those of the white model. States are shown only if they are above the median 18 to 24 population in the 1990 Census, and only if the residuals from one or both models was greater than .015 percentage points or less than -0.15 percentage points of enrollment. The state and year are indicated for the largest outliers.

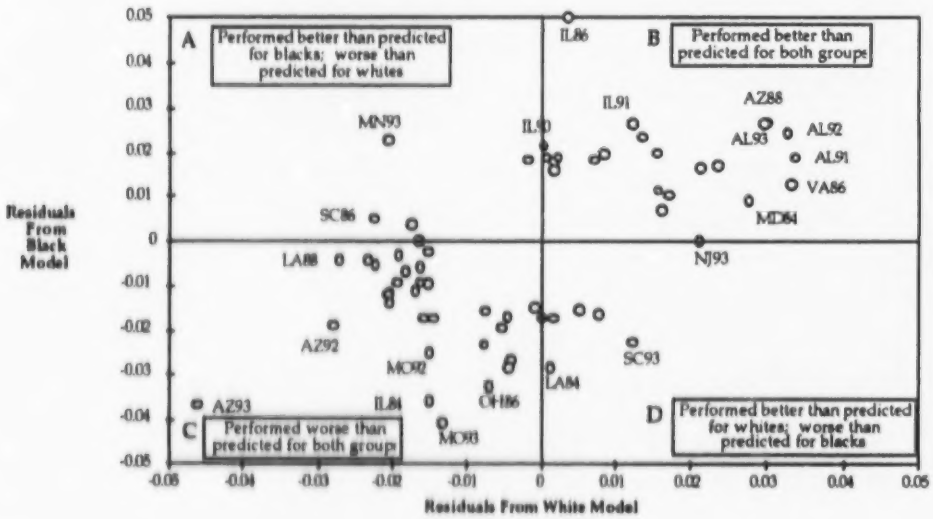

Figure 8: Comparison of Residuals From Black and White Models

Figure 8 allows you to compare the performance level of states given their characteristics outlined above. For example, states in quadrant A (such as Minnesota in 1993) had higher enrollment rates for black students than that predicted by the model, but lower rates for white students. Conversely, those in quadrant D had higher rates for white students

but lower than the predictions for black students. States in quadrant B outperformed the model for both groups, and states in quadrant C had lower enrollment rates for both groups.

This analysis allows you to identify states (and years) where enrollment rates for one or both groups were unusually high or low. While the reasons for these divergences are beyond the scope of this study, this methodology can be a valuable tool for policy analysts and researchers interested in those factors besides price and economic conditions that affect access to public higher education.

Additional opportunities for research that could be conducted using this state-level methodology include:

- Measuring the tuition and aid effects at 4-year colleges and universities versus community colleges — is one sector or the other more sensitive to price?
- Headcount (used in this study) versus full-time equivalent enrollments — are more students being forced to attend college part-time due to rising prices?
- First-time freshman versus total enrollments — are first-time enrollees more price sensitive?
- Testing the effect of using different age cohorts (other than 18-24) in the denominator of the enrollment rate calculation
- Testing the assumption of perfectly elastic supply — how much do public colleges and universities adjust their enrollments to meet market demand?

Appendix A

Tuition and Fees at Public Colleges and Universities, 1989-1990 and 1993-1994 (in Constant Dollars)

Institution/Group	1989-1990 Tuition and Fees	1993-1994 Tuition and Fees (in 1989 dollars)	4-year Change	Annual Change
University of California	$1,673	$3,449	106%	20%
University of Massachusetts	$2,629	$4,453	69%	14%
All Flagship Universities	*$1,968*	*$2,465*	*25%*	*6%*
New York State Colleges	$1,482	$2,543	72%	15%
Texas State Colleges	$973	$1,353	39%	9%
All Comprehensives	*$1,599*	*$1,979*	*24%*	*5%*
Virginia Community Colleges	$798	$1,147	44%	10%
North Carolina Community Colleges	$270	$484	79%	16%
All Community Colleges	*$885*	*$1,070*	*21%*	*5%*
Median Income for 4-Person Families	$40,763	$39,230	-4%	-1%

Source: Washington State Higher Education Coordinating Board (1994), National Center for Education Statistics (1994), and U.S. Bureau of the Census (1995). Tuition and fees (excluding room and board) are for in-state students. The "all" groups include a sample of each type of institution in each state. See Washington State Higher Education Coordinating Board (1994) for more information.

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